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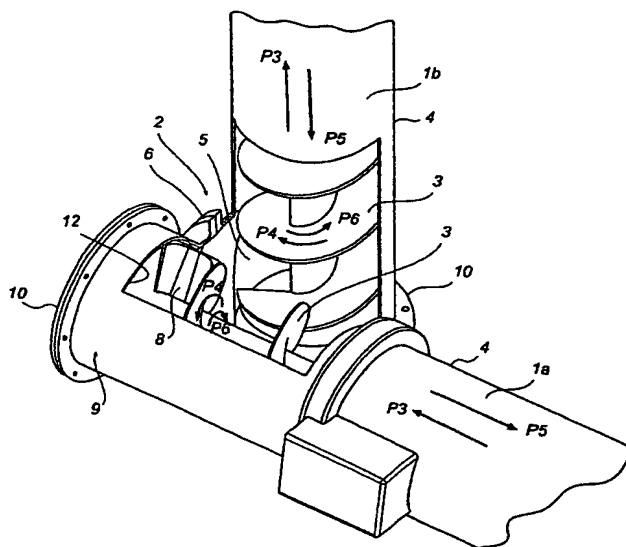
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- (71) Applicant (for all designated States except US): **BMH MARINE AB [SE/SE]; Box 566, S-267 25 Bjuv (SE).**
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **SVENSSON, Kenneth [SE/SE]; Kornetvagen 11, S-286 33 Örkelljunga (SE). LOODBERG, Torsten [SE/SE]; Domarringsvagen 16, S-260 41 Nyhamnslage (SE).**
- (74) Agent: **AWAPATENT AB; Box 5117, S-200 71 Malmö (SE).**
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(54) Title: **A BULK GOODS CONVEYOR WITH A SCOOP, AND ITS APPLICATION**



(57) Abstract: A unit for conveying bulk goods, comprising a first conveyor (1a) of a screw conveyor type extended along a first longitudinal axis, and a second conveyor (1b) extended along a second longitudinal axis. The conveyors (1a, 1b) are angularly connected to each other by means of a transition portion (2). The transition portion (2) is arranged to allow conveying of the bulk goods in an optional direction through the unit. The unit is characterised by a transfer means (8) which is arranged in the transition portion (2) and which, independently of gravity and the spatial orientation of the longitudinal axes, acts to transfer bulk goods between the conveyors (1a, 1b). The invention also relates to a shovel means for such a unit, and a loading and discharging plant comprising at least one such unit.

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A BULK GOODS CONVEYOR WITH A SCOOP, AND ITS APPLICATION

Field of the Invention

The present invention relates to a unit for conveying bulk goods according to the preamble to claim 1, a shovel means for such a unit according to the preamble to claim 24, and a loading and discharging plant comprising one or more such units.

Background Art

In many cases there is a need for moving large amounts of bulk goods, such as cereals, cement, granulate, sewage sludge, paper-making pulp. Both vertical and horizontal moving may be required. A unit allowing such moving operations may comprise a plurality of interconnected screw conveyors, each screw conveyor comprising a screw and a casing which surrounds the screw. By rotation of the screw, the bulk goods are conveyed through the casing.

A unit for conveying bulk goods according to the type described by way of introduction is disclosed in DE-29 05 665. The unit comprises a horizontally extended screw conveyor and a vertically extended screw conveyor. The screw conveyors intersect at a point spaced from their ends and communicate with each other at this point through an opening in the respective casings. An extension, hereinafter referred to as blind gut, is formed between the intersection and the end of each screw conveyor. The horizontal screw has no screw blades in the intersection with the vertical screw and further has a set of oppositely threaded screw blades in the associated blind gut. Finally the screw shafts of the screw conveyors are relatively offset to allow interconnection.

A thus designed screw conveyor allows conveying of bulk goods in the horizontal screw conveyor and from there to the vertical conveyor. More specifically, the bulk goods will be moved by the horizontal screw to the intersection, in which the vertical screw engages the bulk goods and move them on. Bulk goods which possibly are moved past the intersection will meet the oppositely threaded screw blades which then engage the bulk goods and move them back to the intersection, thereby preventing stoppage owing to bulk goods being pressed into the blind gut.

The above prior-art unit for conveying bulk goods, however, suffers from a serious drawback. It is in fact not possible to convey the bulk goods away from the vertical to the horizontal screw conveyor. This is due to the fact that bulk goods which are conveyed downwards in the vertical screw conveyor will inevitably be moved into the associated blind gut and thus cause stoppage in the unit. If the bulk goods would be conducted into the horizontal screw conveyor, the oppositely threaded screw blades will engage parts of the bulk goods and thus convey them in the blind gut of the horizontal screw conveyor. This may also cause stoppage in the unit.

This problem has been solved by a unit according to EP-0 096 673. This unit comprises a vertical screw conveyor, to which a horizontal screw conveyor is connected. For the purpose of distinguishing the two screw conveyors, the vertical screw conveyor will below be designated S1 and the horizontal screw conveyor will be designated S2. More specifically, S1 has an opening which is formed in the circumferential surface of its casing and which is arranged opposite to an opening which is formed in the end wall of a casing of S2. An inclined metal sheet is arranged in S1 to prevent bulk goods from being moved into a blind gut formed behind the opening. When bulk goods are conveyed from S1 to S2, they will be thrown out of the opening and thus be supplied to S2,

whose screw engages the bulk goods and conveys them on. The metal sheet prevents bulk goods from being moved past the opening of S2 and into the blind gut. When conveying bulk goods in the opposite direction, they will be pushed
5 from S2 to S1, whose screw then engages the bulk goods and conveys them on.

The problem of this prior-art unit is, however, that it cannot be arranged in any other way in space. In particular it is not possible to change the orientation
10 of S2.

The reason for this is that S2, whose screw is spaced from the screw of S1 so as not to engage the same, is a so-called horizontal screw conveyor which pushes or scrapes the bulk goods forwards along one of its sides.
15 If such a screw conveyor is arranged at an angle that deviates excessively from the horizontal position, it does not work at all.

Even if S2 were designed as a vertical screw conveyor so that the unit would comprise two vertical screw conveyors, a unit that can be arranged in the desirable
20 manner in space would not be provided. A vertical screw conveyor acts in such a manner that it makes the bulk goods be conveyed along a helical path. The bulk goods do not move at the same high speed of rotation as the screw
25 itself and the pitch of the helical path is steeper than the pitch of the screw. Thus the bulk goods will have an axial direction of motion. If S2 were designed as a vertical screw conveyor and besides arranged vertically and if S1 were arranged horizontally, this would mean that a
30 working unit that allows conveying of bulk goods in both directions would not be provided in any case. If bulk goods were conveyed from S2 to S1, they would certainly be thrown from S2 towards S1. Gravity as well as the rotation of the screw of S1 would, however, cause the
35 bulk goods to be returned to S2.

There is thus a need for a unit for conveying of bulk goods, which allows conveying of the bulk goods

in an optional direction through the unit and which with its function maintained can be spatially oriented in an optional manner.

When discharging a vessel, a vessel discharging plant made up of a plurality of conveyors, such as screw conveyors and belt conveyors, is often used. The conveyors are then mutually movable and turnable to allow the plant to be operated in cargo spaces of the vessel to allow good emptying thereof. For loading the vessel, use is made of a separate loading plant. It goes without saying that the provision of two separate plants results in high investment costs.

There is thus also a need for a plant which allows both loading and discharging of vessels.

Summary of the Invention

A first object of the present invention is to provide a new and improved unit for conveying bulk goods. A special object is to provide such a unit as allows conveying of bulk goods in an optional direction through the unit independently of the orientation of conveyors included in the unit.

A second object of the present invention is to provide a shovel means intended for such a unit and allowing conveying of bulk goods in an optional direction through the unit.

A third object of the invention is to provide a plant which allows both loading and discharging of vessels.

When discussing, above as well as below, conveying of bulk goods in an optional direction through a unit, this relates to the fact that the unit defines an extended conveying path and that the bulk goods can be conveyed along this conveying path in both directions.

To achieve the first object, a unit for conveying bulk goods is provided in accordance with the features

stated in claim 1. Preferred embodiments of the unit are defined in the subclaims 2-23.

To achieve the second object, a shovel means is provided in accordance with the features of claim 24. Preferred
5 embodiments of the shovel means are defined in the subclaims 25-27.

To achieve the third object, a plant is provided in accordance with the features of claim 28. A preferred embodiment of the plant is defined in the subclaim 29.

10 More specifically, according to the invention a unit is provided for conveying bulk goods, comprising a first conveyor of a screw conveyor type, extended along a first longitudinal axis, and a second conveyor extended along a second longitudinal axis, said conveyors being angularly
15 connected to each other by means of a transition portion, the transition portion being adapted to allow conveying of the bulk goods in an optional direction through the unit, said unit being characterised by a transfer means which is arranged in the transition portion and which,
20 independently of gravity and the spatial orientation of the longitudinal axes, acts to transfer bulk goods between the conveyors.

This results in a unit which independently of orientation of the conveyors included in the unit allows conveying of bulk goods in an optional direction through the
25 unit.

Preferably, the conveyors are mutually turnable for adjusting the orientation of the longitudinal axes relative to each other. This results in a unit which in operation can be set so that the conveyors of the unit take
30 the desired extent in space.

According to a preferred embodiment of the inventive unit, also the second conveyor is of a screw conveyor type.

35 Preferably, the transfer means comprises a shovel means arranged in the first conveyor and adapted to feed bulk goods towards the second conveyor.

The term shovel means is considered to comprise all types of devices, which by rotation engage the bulk goods and thus guide the flow of goods in the desired direction.

5 If the second conveyor is of a screw conveyor type, the transfer means can also comprise a shovel means which is arranged in the second conveyor and which is adapted to feed bulk goods towards the first conveyor.

10 The shovel means is preferably rotatable to cause said feeding. This makes it possible to arrange the shovel means on a screw shaft of the conveyor.

The shovel means can form an end of the screw, wherein the shovel means can be arranged immediately adjacent to a last screw blade of the screw or be
15 arranged at a distance from a last screw blade of the screw. The shovel means can also be arranged on a last screw blade of the screw.

20 According to an embodiment, the shovel means comprises at least one blade and preferably more than one blade.

Preferably the shovel means is only arranged for said feeding of bulk goods if the bulk goods are being conveyed through the unit away from the conveyor in which the shovel means is arranged to the conveyor connected
25 thereto. This ensures that the shovel means does not counteract transfer of bulk goods from one conveyor to the conveyor in which the shovel means is arranged. This is suitably accomplished by the shovel means having a lee-side, which, if the bulk goods are conveyed through
30 the unit away from the conveyor connected thereto to the conveyor in which the shovel means is arranged, is arranged for conveying bulk goods away from the conveyor connected thereto.

35 The shovel means may comprise an engaging surface, which is arranged on a first side of a screw blade, said first side acting to convey bulk goods towards the conveyor connected thereto, and which is thus arranged for

engagement with and said feeding of the bulk goods if conveyed in said direction, and a lee-side which constitutes part of a second side of the screw blade, said second side acting to convey bulk goods away from the conveyor connected thereto.

Preferably, parts of the shovel means are designed to control the flow of goods and the speed of goods in the transfer of the bulk goods.

According to a preferred embodiment of the unit, the transition portion is designed in such manner that the first conveyor through an opening in the circumferential surface of a casing of the same is connected to the second conveyor.

If the second conveyor is of a screw conveyor type, it is advantageously connected to the first conveyor through an opening in an end wall of a casing of the second conveyor. Preferably the transfer means comprises in this case only one shovel means arranged in the first conveyor, whereby the transfer means is only arranged for transfer of bulk goods away from the first conveyor to the second screw conveyor. When conveying bulk goods away from the first conveyor to the second conveyor, the transfer means will, as stated, ensure that the bulk goods are transferred from the first to the second conveyor. If the bulk goods are conveyed in the opposite direction, i.e. from the second to the first conveyor, the bulk goods will be transferred from the second to the first conveyor by way of the axial conveying of goods caused by the screw of the second conveyor, said screw discharging the goods through the opening in the end wall of the second conveyor and feeding the goods into the first conveyor through the opening in the circumferential surface of its casing.

If the second conveyor is of a screw conveyor type, this too can advantageously be connected to the first conveyor through an opening in the circumferential surface of a casing of the second conveyor. The transfer

means suitably comprises a shovel means arranged in each conveyor, whereby the transfer means is arranged for transfer of bulk goods in both directions.

5 The transition portion is preferably designed in such manner that one or both of the conveyors is turnable in a plane perpendicular to the longitudinal axis of the conveyor connected thereto to allow different angular settings between the conveyors.

10 The transition portion can also be designed in such manner that one or both of the conveyors is turnable in a plane parallel with the longitudinal axis of the conveyor connected thereto to allow different angular settings between the conveyors. This allows angular setting of the conveyors in all solid angles.

15 Preferably the inner space of the transition portion is minimised to ensure good flow and good emptying in connection with the final emptying of the unit.

Moreover, the invention provides a shovel means for discharging bulk goods from a screw conveyor through an opening in the circumferential surface of a casing thereof, said shovel means being characterised by an engaging surface which is arranged on a first side of a screw blade arranged in the casing, said first side during rotation in a first direction acting to convey bulk goods towards the opening, and which during rotation in said direction is arranged for engagement with the bulk goods to discharge the bulk goods through the opening, and a lee-side, which constitutes a second side of the screw blade, said second side during rotation in a second direction opposite to the first direction preventing the engaging means from engaging bulk goods and acting to convey bulk goods away from the opening.

30 The shovel means can be arranged immediately adjacent to a last screw blade of a screw arranged in the casing.

Alternatively, the shovel means can be arranged at a distance from a last blade of a screw arranged in the casing.

Alternatively, the shovel can form a last blade of
5 a screw arranged in the casing.

Finally, according to the invention a plant is provided, which comprises at least one unit as defined above, thus making the plant usable for loading a vessel with bulk goods by driving the conveyors included therein
10 in a first direction and for discharging bulk goods from the vessel by driving the conveyors included therein in a second reverse direction. Preferably, all conveyors included in the plant are of a screw conveyor type.

Preferred embodiments of the invention will now be
15 described with reference to the accompanying drawings.

Brief Description of the Drawings

Fig. 1 is a perspective view of a first embodiment of a unit according to the present invention.

20 Fig. 2 is a perspective view of a unit according to Fig. 1, the unit however comprising a turnable portion.

Fig. 3 is a perspective exploded view of the unit in Fig. 2.

Fig. 4 is a view of part of the unit shown in
25 Fig. 2, with partly removed casings of two screw conveyors included in the unit.

Fig. 5 is a perspective view of a second embodiment of a unit according to the present invention.

Fig. 6 is a perspective view of a first embodiment
30 of a shovel means according to the present invention.

Fig. 7 is perspective view of the shovel means shown in Fig. 5, in the form of a separate member.

Fig. 8 is a perspective view of a second embodiment of a shovel means according to the present invention.

35 Fig. 9 is a schematic view of a plant for loading and discharging of vessels according to the invention.

Description of Embodiments

A unit as referred to in Fig. 1 for conveying bulk goods according to a first embodiment of the present invention comprises a first 1a and a second 1b screw conveyor, which are interconnected by means of a transition portion 2.

Each screw conveyor 1a, 1b comprises a screw 3 and a casing 4 enclosing the screw 3 and has in the area of said transition portion 2, i.e. at its one end, an opening 5 formed in the circumferential surface of the casing 4. The openings 5 of the screw conveyors 1a, 1b are arranged opposite to each other, whereby the screw conveyors 1a, 1b communicate with each other. A transition part 6 is arranged between the openings 5. The transition part 6 is articulated to allow turning, in the direction indicated by the double arrow P1, of one screw conveyor 1a; 1b, relative to the other 1b; 1a. This allows angular setting of one of the screw conveyors 1a, 1b in a plane which is parallel with the longitudinal axis of the other of the screw conveyors 1a, 1b. Of course, it is also possible to design the transition part 6 so that the conveyors 1a, 1b are rigidly interconnected.

According to a variant as shown in Fig. 2 of the unit shown in Fig. 1, the unit comprises in addition to said transition part 6 a turnable portion 7 of the first screw conveyor 1a. This portion 7 allows turning, in the direction indicated by the double arrow P2, of the second screw conveyor 1b in a plane which is perpendicular to the longitudinal axis of the first screw conveyor 1a. This ensures that the second screw conveyor 1b is settable in all solid angles.

It will be appreciated that also the second screw conveyor 1b can have such a turnable portion to allow setting of the first screw conveyor 1a in all solid angles.

The transition part 6 of the variants of the first embodiment of the inventive unit as shown in Figs 1 and 2

is suitably designed in such manner that its inner space is minimised. This means that the screw conveyors 1a, 1b are arranged as close as possible to each other, which ensures a good flow of goods and good emptying of said transition part 6 in connection with the final emptying of the unit, i.e. when the operation is to be terminated.

Fig. 3 shows the unit in Fig. 2 in an exploded view. It is clearly shown in the Figure how an opening 5 is formed in the casing 4 of each screw conveyor 1a, 1b and how a transition part 6 is arranged between the openings 5.

Fig. 4, to which reference is now made, illustrates still more clearly the transition portion 2 between the first 1a and the second 1b screw conveyor of the variant of the first embodiment of the unit as shown in Fig. 2. However, the transition portion 2 has the same fundamental design in the variant shown in Fig. 1.

Each screw 3 carries a transfer means in the form of a shovel means 8 (of which only the shovel means 8 of the first screw conveyor 1a is shown), which is arranged in connection with the opening 5 formed in the associated casing 4. The two shovel means 8 are thus rotatable by rotation of the respective screws 3.

A so-called blind gut 9 is formed between the end wall 10 and the opening 5 of each screw conveyor 1a, 1b. As is shown, no blade of the respective screws 3 is, however, arranged in these blind guts 9, but the shovel means 8 extend into the blind guts 9 and thus prevent bulk goods from being pressed into the same.

In operation of the unit, the screws are rotated by drive means (not shown), such as electric motors.

If the bulk goods are to be conveyed in the direction indicated by arrows P3 from the first 1a to the second 1b screw conveyor, the two screws 3 are rotated in the direction indicated by arrows P4. The bulk goods are supplied to the first screw conveyor 1a by means of a suitably arranged feeding device of prior-art type. Its

screw 3 will engage the bulk goods and convey them in the direction P3 towards the transition portion 2. As the bulk goods reach the shovel means 8 arranged in the same screw conveyor 1a, this shovel means will engage the bulk goods and convert the essentially axial conveyance of the bulk goods into a conveyance in the direction of rotation along the inner wall 12 of the casing 4. When, during this conveyance in the direction of rotation, the bulk goods reach the area of the casing 4, in which area the opening 5 is formed, the bulk goods will be thrown out of the opening 5 and be transferred to the second screw conveyor 1b. More specifically, the bulk goods will be discharged through the opening 5 and fed into the transition part 6 and, from there, into the second screw conveyor 1b through its opening 5. Here the screw 3 arranged therein engages the bulk goods and conveys them in the direction P3 from the transition portion 2 to a suitably arranged discharge opening.

The bulk goods will consequently not be pressed into the blind gut 9 of the first screw conveyor 1a, but the shovel means 8 arranged therein ensures that the blind gut 9 is continuously emptied.

The blind gut 9 can of course extend a distance away from the shovel means 8. In that case it would be possible for part of the bulk goods to be introduced into the blind gut, but as soon as the blind gut 9 is filled, the shovel means 8 ensures that additional bulk goods cannot be pressed into the same.

For conveying bulk goods in the reverse direction indicated by the arrows P5, i.e. from the second 1b to the first 1a screw conveyor, the screws 3 are rotated in the opposite direction indicated by the arrows P6. However, the function is essentially the same except that it is the shovel means 8 arranged in the second screw conveyor 1b that transfers the bulk goods between the screw conveyors 1a, 1b.

The shovel means 8 shown in Fig. 4 are designed in such manner that they exclusively act to transfer bulk goods if the bulk goods are conveyed away from the screw conveyor 1a; 1b in which the shovel means 8 in question is arranged, to the screw conveyor 1b; 1a connected thereto. This is achieved by each shovel means 8 having a lee-side, which if the bulk goods are conveyed in the opposite direction engages the bulk goods and does not act to transfer bulk goods. A thus designed shovel means will be described in more detail below with reference to Fig. 6.

However, the shovel means 8 can be designed in a different way, and an example of a second embodiment of the shovel means 8 will be described with reference to Figs 7 and 8.

Fig. 5, to which reference is now made, illustrates a second embodiment of the unit according to the invention. Components equivalent to those described with reference to Figs 1-4 have been given the same reference numerals.

The unit comprises, as described above, a first 1a and a second 1b screw conveyor, which are angularly interconnected by means of a transition portion 2.

Also in this embodiment the first screw conveyor 1a has an opening 5 formed in the circumferential surface of its casing 4. The second screw conveyor 1b, however, has an opening 5, which is formed essentially in the end wall 10 of its casing 4 and which is arranged opposite to the opening 5 of the first screw conveyor 1a, whereby the screw conveyors 1a, 1b communicate with each other. As shown in Fig. 5, the mutually perpendicular longitudinal axes of the screw conveyors 1a, 1b are also relatively offset. This results in a better transfer of the bulk goods from the second screw conveyor 1b to the first screw conveyor 1a, which will be explained in more detail below.

The unit comprises only one transfer means in the form of a shovel means 8 (not shown) arranged in the first screw conveyor 1a. The shovel means 8 is arranged on a screw 3 in the first screw conveyor 1a in the same way as the shovel means 8 are arranged on the screws 3 in the respective screw conveyors 1a, 1b of the previously described first embodiment of the unit. The shovel means 8 thus acts only to transfer bulk goods away from the first 1a to the second 1b screw conveyor.

The screws 3, of which only the screw 3 of the second screw conveyor 1b is shown in Fig. 5, are rotatable with the aid of drive means (not shown) and thus also the shovel means 8 is rotatable by rotation of the screw 3 of the first screw conveyor 1a.

If bulk goods are conveyed in the direction P7 from the first 1a to the second 1b screw conveyor, the shovel means 8 will engage the bulk goods and discharge them through the opening 5 in the casing 4 of the first screw conveyor 1a and feed them through the opening 5 in the end wall 10 of the casing 5 of the second screw conveyor 1b. Subsequently the screw 3 of the second screw conveyor 1b engages the bulk goods and conveys them further in the direction P7, i.e. away from the transition portion 2.

If bulk goods are conveyed in the reverse direction P8, i.e. if the screws 3 are rotated in the opposite direction, the bulk goods conveyed by the screw 3 in the second screw conveyor 1b will be discharged from the first screw conveyor 1a through the opening 5 formed in the end wall 10 of its casing 4. While being conveyed through the second screw conveyor 1b, the bulk goods will, owing to the rotation of the screw 3, be applied essentially to an inner side of the casing 4. Thanks to the fact that the screw conveyors 1a and 1b are relatively offset, this side is arranged in front of the opening of the first screw conveyor 1a, and thus an essentially central feeding of the bulk goods into the first screw conveyor 1a is obtained. The screw 3 of the first screw

conveyor 1a will then engage the bulk goods for further conveying away from the transition portion 2. Consequently, no shovel means is required in the second screw conveyor 1b.

5 Two examples of embodiments of the shovel means 8, which are usable in this second embodiment of the unit, will now be described with reference to Figs 6-8.

The two embodiments of the unit as described are advantageous by allowing conveyance of bulk goods in an optional direction through the unit. A particular advantage is that this conveyance in an optional direction is independent of the way the conveyors of the unit are oriented since the transfer of the bulk goods between the conveyors is accomplished with the aid of a transfer means in each screw conveyor or with the aid of a transfer means in one conveyor and a screw in the other conveyor. The transfer is thus independent of gravity. The entire unit can thus be moved and turned while conveyance is still allowed in an optional direction. By turnably interconnecting the conveyors, it is possible, in operation of the unit, to vary the mutual orientation of the conveyors while maintaining the capability of the unit of conveying bulk goods in both directions. A unit is thus provided, which independently of gravity allows conveyance of bulk goods in an optional direction through the unit.

It will be appreciated that a unit according to the present invention may comprise more than two conveyors, in which case interconnected conveyors are arranged in one of the manners described above.

A first embodiment of the shovel means 8 is shown in Fig. 6. The shovel means 8 forms an end of a screw 3 and comprises an engaging side 13 and a lee-side 14. The lee-side 14 is formed of a first side 15 of a blade 16 of the screw 3. The engaging side 13 is arranged on a second side 17 of the blade 16 at a certain distance from the end of the blade 16. The engaging side 13 is essentially

arranged in a plane extended by the longitudinal axis of the screw 3 and an axis extended radially to said longitudinal axis.

When rotating the screw 3 in the direction indicated by arrow P9, bulk goods will be conveyed by the second side 17 of the screw 3 in the direction P11 towards the shovel means 8. As the engaging side 13 of the shovel means 8 engages the bulk goods, the essentially axial conveyance of the bulk goods will be converted into conveyance of the bulk goods in the direction of rotation. As described above with reference to, for example, Fig. 4, a casing 4 encloses the screw 3. The casing 4 has an opening 5 formed in its circumferential surface in the area of said shovel means 8. The bulk goods will thus be pushed by the engaging side 13 of the shovel means 8 along the inner wall 12 of the casing 4 up to the opening 5 through which the bulk goods will later on be discharged.

If the screw 3 is rotated in the opposite direction P10, the bulk goods will be conveyed in the reverse direction P12, the first side 15 of the screw 3 engaging the bulk goods. The lee-side 14 of the shovel means 8, which thus forms part of said first side 15 of the screw 3, acts to convey the bulk goods in the same direction P12. More specifically, the lee-side 14 is arranged in such manner that the engaging side 13 during rotation in the direction P10 will be sheltered behind said lee-side. The engaging side 13 is thus prevented from engaging the bulk goods, and thus the bulk goods will not be conveyed in the direction of rotation during rotation in the direction P10.

Consequently, a shovel means 8 is provided, which acts to transfer bulk goods only if the bulk goods are conveyed by the conveyor in which the shovel means is arranged, towards the shovel means 8.

It will be appreciated that a thus designed shovel means 8 need not necessarily be an integrated part of a

screw 3. Fig. 7 shows a shovel means 8, which comprises an engaging side 13 and a lee-side 14 and which can be arranged as a separate member on a screw shaft 18 or on a separately operable shaft which is not connected to the screw shaft 18. The shovel means 8 can be arranged immediately adjacent to a last blade 16 of the screw 3 or at a certain distance therefrom.

The engaging side 13 of the shovel means 8 is suitably designed to control the flow of goods and the speed of goods when transferring the bulk goods.

Fig. 8 illustrates a second embodiment of a shovel means 8 according to the invention. The shovel means 8 comprises five paddles or blades 19, which extend radially away from the screw shaft 18 and which are arranged in planes parallel with the longitudinal axis of the screw 3. The blades 19 can be straight or curved for controlling the flow of goods and the speed of goods when transferring the bulk goods.

A thus designed shovel means 8 acts to discharge bulk goods independently of the direction in which the bulk goods are conveyed through the unit. If such a shovel means 8 is used in one of the units described above, this, of course, results in the shovel means 8 counteracting conveyance of bulk goods in a direction opposite to the direction in which the shovel means 8 acts. For the embodiment of the unit described with reference to Figs 1-4, in which two screw conveyors 1a, 1b communicate with each other through an opening 5 formed in the circumferential surface of each casing 4, this means, for example, that bulk goods which are transferred by the shovel means 8 arranged in the first screw conveyor 1a from said screw conveyor 1a to the screw conveyor 1b connected thereto, will be supplied to the shovel means 8 in the screw conveyor 1b connected thereto. The shovel means 8 will engage the bulk goods and counteract said transfer. The feeding pressure of the bulk goods, which is produced by the screw 3 of the first

screw conveyor 1a, will however overcome the counteracting effect caused by the shovel means 8 in the second screw conveyor 1b, and therefore conveyance of the bulk goods through the unit in the desired direction will
5 still be allowed.

This second embodiment of the shovel means 8 also results in a higher consumption of energy of the unit.

The shovel means 8 can comprise one or more blades 19. The shovel means 8 can further be arranged immediately adjacent to or at a distance from a last blade 16 of
10 the screw 3.

It will also be appreciated that the shown embodiments of the shovel means need not necessarily be arranged on a screw shaft of the conveyor. The shovel means
15 can, of course, be arranged so as to be separately operable, thus making it possible to optimise the speed at which the shovel means is rotated.

In the two embodiments of the inventive unit as described above, the conveyors included in the unit are
20 said to be screw conveyors. However, it will be appreciated that it is possible to replace one of the screw conveyors with a conveyor of a different type. In the second embodiment of the unit described above, it is thus possible to replace the second screw conveyor, which
25 through an opening in the end wall of its casing communicates with the first screw conveyor, with a conveyor of a different type. Conveyance of bulk goods in an optional direction through the unit will nevertheless be allowed.

Fig. 9 illustrates a plant 20 for loading and discharging of vessels. The plant 20 comprises a plurality
30 of interconnected conveyors 1. By using a plurality of interconnected units according to the invention, a plant 20 for loading and discharging of vessels 21 is provided, which plant 20 can be changed from loading to discharging
35 by simply changing the direction in which the screws of the unit are rotated. The units are mutually turnable to allow sufficient access to the different cargo spaces 22

of the vessel 21. Owing to the gravity independence of the units, a satisfactory function of the plant 20 is ensured independently of the way in which the units are oriented and independently of the direction in which the bulk goods are conveyed through the interconnected units of the plant 20. The need for separate plants for loading and discharging has thus been eliminated.

It will be appreciated that several modifications and variations can be provided within the scope of the invention. Thus the extent of the invention is only defined by the appended claims.

CLAIMS

1. A unit for conveying bulk goods, comprising
5 a first conveyor (1a) of a screw conveyor type,
extended along a first longitudinal axis, and
a second conveyor (1b) extended along a second
longitudinal axis,
said conveyors (1a, 1b) being angularly connected
10 to each other by means of a transition portion (2),
the transition portion (2) being adapted to allow
conveying of the bulk goods in an optional direction
through the unit,
c h a r a c t e r i s e d b y
15 a transfer means (8) which is arranged in the tran-
sition portion (2) and which, independently of gravity
and the spatial orientation of the longitudinal axes,
acts to transfer bulk goods between the conveyors (1a,
1b).
- 20 2. A unit as claimed in claim 1, wherein the con-
veyors (1a, 1b) are mutually turnable for adjusting the
orientation of the longitudinal axes relative to each
other.
3. A unit as claimed in claim 1 or 2, wherein also
25 the second conveyor (1b) is of a screw conveyor type.
4. A unit as claimed in any one of the preceding
claims, wherein the transfer means (8) comprises a shovel
means (8) which is arranged in the first conveyor (1a)
and which is adapted to feed bulk goods towards the
30 second conveyor (1b).
5. A unit as claimed in claim 4 when referring to
claim 3, wherein the transfer means (8) also comprises a
shovel means (8) which is arranged in the second conveyor
(1b) and which is adapted to feed bulk goods towards the
35 first conveyor (1a).
6. A unit as claimed in claim 4 or 5, wherein each
shovel means (8) is rotatable to cause said feeding.

7. A unit as claimed in claim 6, wherein each shovel means (8) constitutes an end of a screw (3) of the respective conveyors (1a, 1b).

8. A unit as claimed in claim 7, wherein each shovel
5 means (8) is arranged immediately adjacent to a last screw blade (16) of the screw (3).

9. A unit as claimed in claim 7, wherein each shovel means (8) is arranged at a distance from a last screw blade (16) of the screw (3).

10 10. A unit as claimed in claim 7, wherein each shovel means (8) is arranged on a last screw blade (16) of the screw (3).

11. A unit as claimed in any one of claims 4-10, wherein each shovel means (8) comprises at least one
15 blade (19).

12. A unit as claimed in any one of claims 4-11, wherein each shovel means (8) is only arranged for said feeding of bulk goods if the bulk goods are conveyed through the unit away from the conveyor (1a; 1b) in which
20 the shovel means (8) is arranged, to the conveyor (1b; 1a) connected thereto.

13. A unit as claimed in claim 12, wherein each shovel means (8) has a lee-side (14), which, if the bulk goods are conveyed through the unit away from the conveyor (1b; 1a) connected thereto to the conveyor (1a; 1b)
25 in which the shovel means (8) is arranged, is arranged for conveying bulk goods away from the conveyor (1b; 1a) connected thereto.

14. A unit as claimed in claim 13, wherein each
30 shovel means (8) comprises an engaging surface (13), which is arranged on a first side (17) of a screw blade (16), said first side (17) acting to convey bulk goods towards the conveyor (1b; 1a) connected thereto, and which is thus arranged for engagement with and said feed-
35 ing of the bulk goods if conveyed in said direction, and a lee-side (14) which constitutes part of a second side (15) of the screw blade (16), said second side (15) act-

ing to convey bulk goods away from the conveyor connected thereto (1b; 1a).

15. A unit as claimed in any one of claim 4-14, wherein parts of each shovel means (8) are designed to control the flow of goods and the speed of goods in the transfer of the bulk goods.

16. A unit as claimed in any one of claims 4-15, wherein the transition portion (2) is designed in such manner that the first conveyor (1a) through an opening in the circumferential surface of a casing (4) of the same is connected to the second conveyor (1b).

17. A unit as claimed in claim 16, wherein the second conveyor (1b) is of a screw conveyor type and the first conveyor (1a) connects to the second conveyor (1b) through an opening (5) in an end wall (10) of a casing (4) of the second conveyor (1b).

18. A unit as claimed in claim 17, wherein the transfer means (8) comprises only one shovel means (8) arranged in the first conveyor (1a), whereby the transfer means (8) is only arranged for transfer of bulk goods away from the first conveyor (1a) to the second screw conveyor (1b).

19. A unit as claimed in claim 16, wherein the second conveyor (1b) is of a screw conveyor type and the first conveyor (1a) connects to the second conveyor (1b) through an opening (5) in the circumferential surface of a casing (4) of the second conveyor (1b).

20. A unit as claimed in claim 19, wherein the transfer means (8) comprises a shovel means (8) arranged in each conveyor (1a, 1b), whereby the transfer means (8) is arranged for transfer of bulk goods in both directions.

21. A unit as claimed in any one of the preceding claims, wherein the transition portion (2) is designed in such manner that one or both of the conveyors (1a; 1b) is turnable in a plane perpendicular to the longitudinal axis of the conveyor (1b; 1a) connected thereto to allow

different angular settings between the conveyors (1a, 1b).

22. A unit as claimed in any one of the preceding claims, wherein the transition portion (2) is designed in such manner that one or both of the conveyors (1a; 1b) is turnable in a plane parallel with the longitudinal axis of the conveyor (1b; 1a) connected thereto to allow different angular settings between the conveyors (1a, 1b).

23. A unit as claimed in any one of the preceding claims, wherein the inner space of the transition portion (2) is minimised to ensure a good flow and good emptying in connection with the final emptying of the unit.

24. A shovel means for discharging bulk goods from a screw conveyor (1a, 1b) through an opening (5) in the circumferential surface of a casing (4) thereof,

characterised by

an engaging surface (13) which is arranged on a first side (17) of a screw blade (16) arranged in the casing (4), said first side (17) during rotation in a first direction acting to convey bulk goods towards the opening (5), and which during rotation in said direction is arranged for engagement with the bulk goods to discharge the bulk goods through the opening (5), and a lee-side (14), which constitutes a second side (15) of the screw blade (16), said second side (15) during rotation in a second direction opposite to the first direction preventing the engaging means (13) from engaging bulk goods and acting to convey bulk goods away from the opening (5).

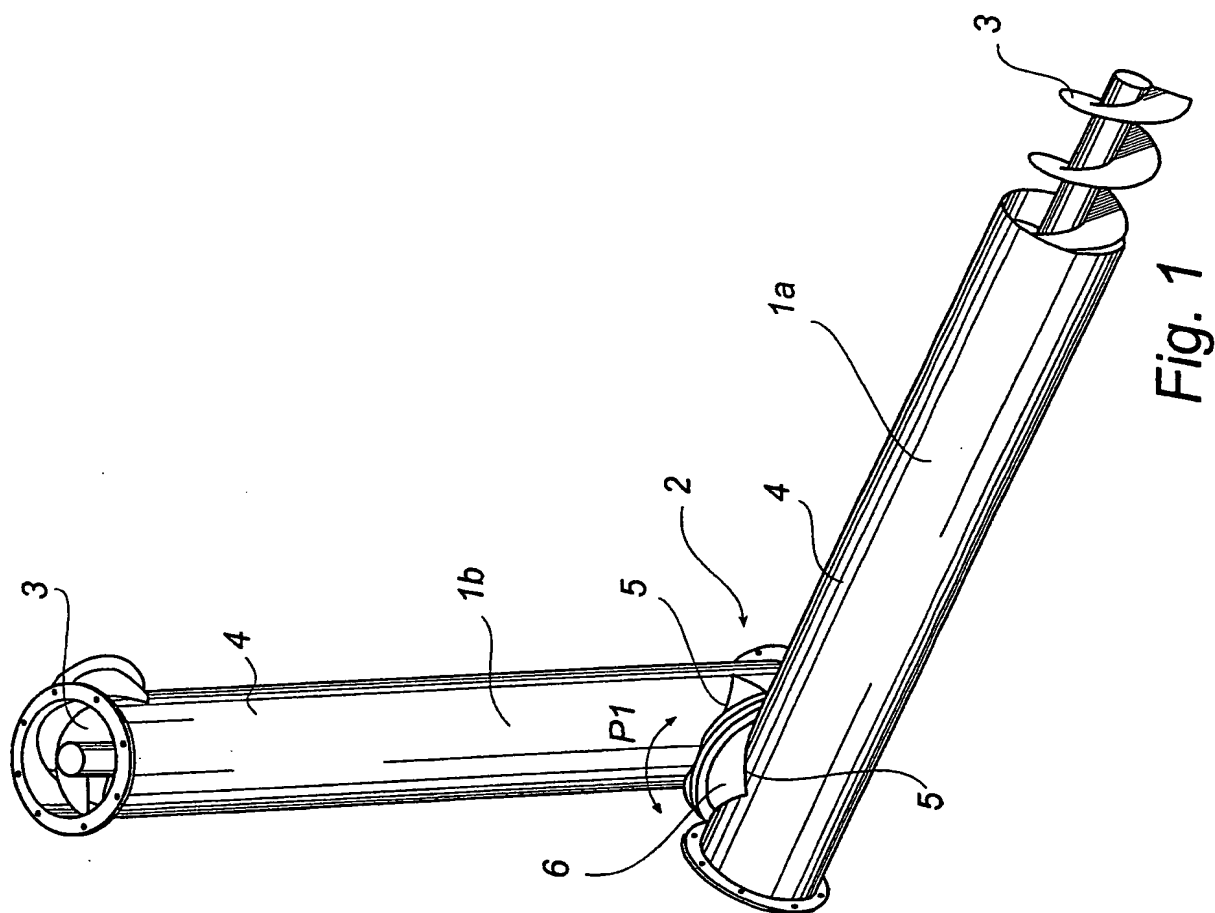
25. A shovel means as claimed in claim 24, wherein the shovel means (8) is arranged immediately adjacent to a last screw blade (16) of a screw (3) arranged in the casing (4).

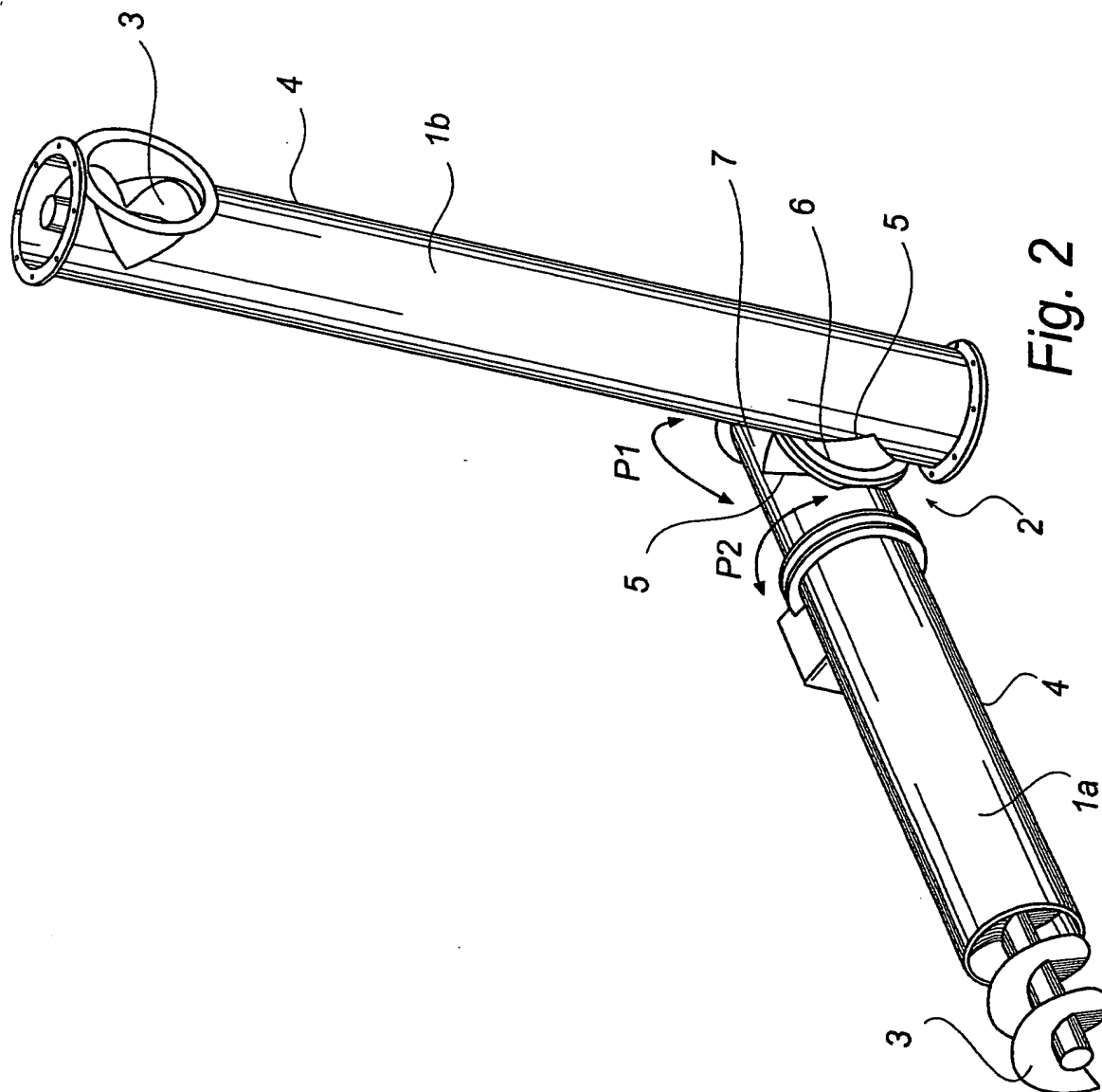
26. A shovel means as claimed in claim 24, wherein the shovel means (8) is arranged at a distance from a last screw blade (16) of a screw (3) arranged in the casing (4).

27. A shovel means as claimed in claim 24, wherein the shovel means (8) constitutes a last screw blade (16) of a screw (3) arranged in the casing (4).

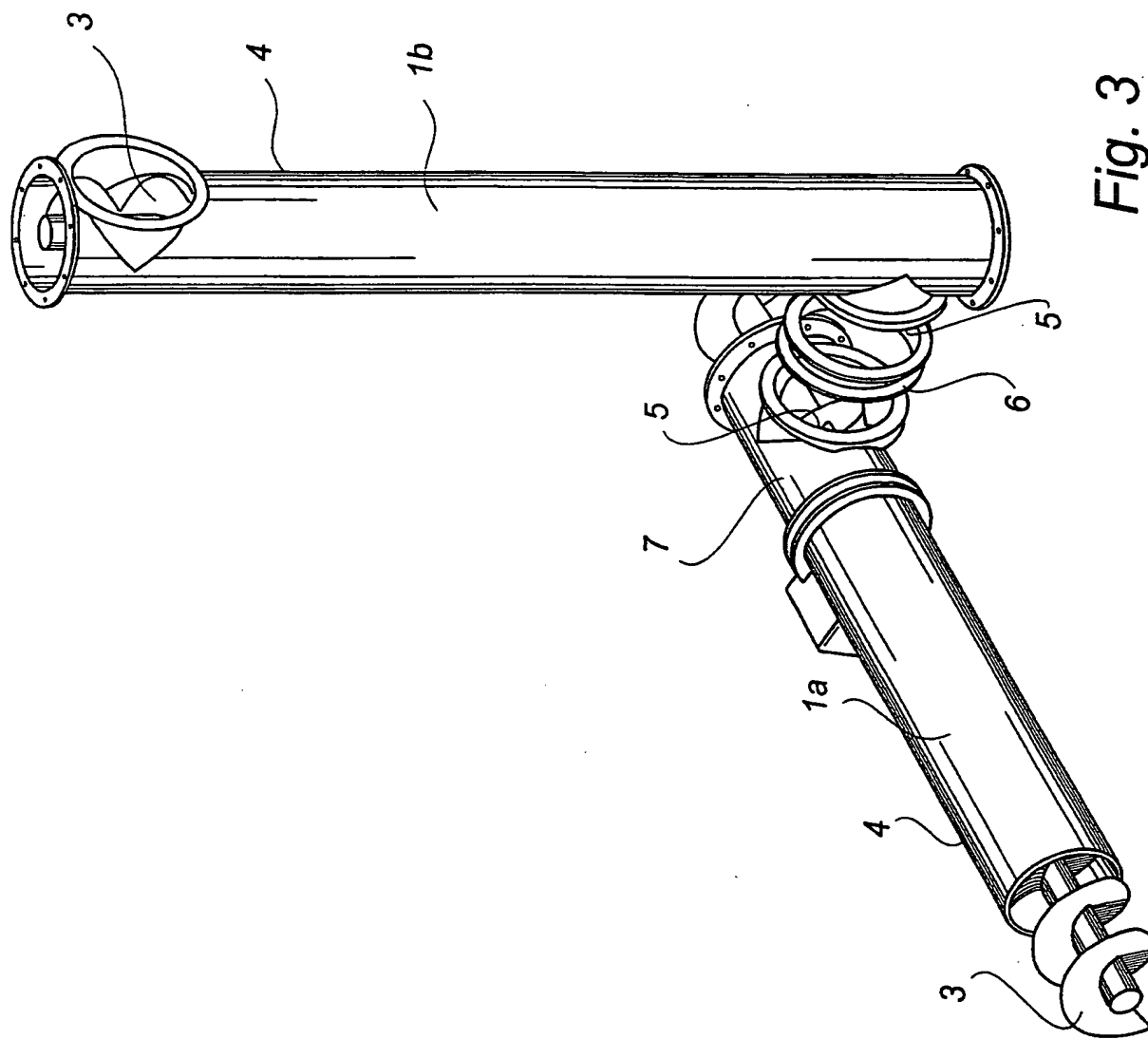
28. A loading and discharging plant for vessels,
5 c h a r a c t e r i s e d by at least one unit as claimed in any one of claims 1-23.

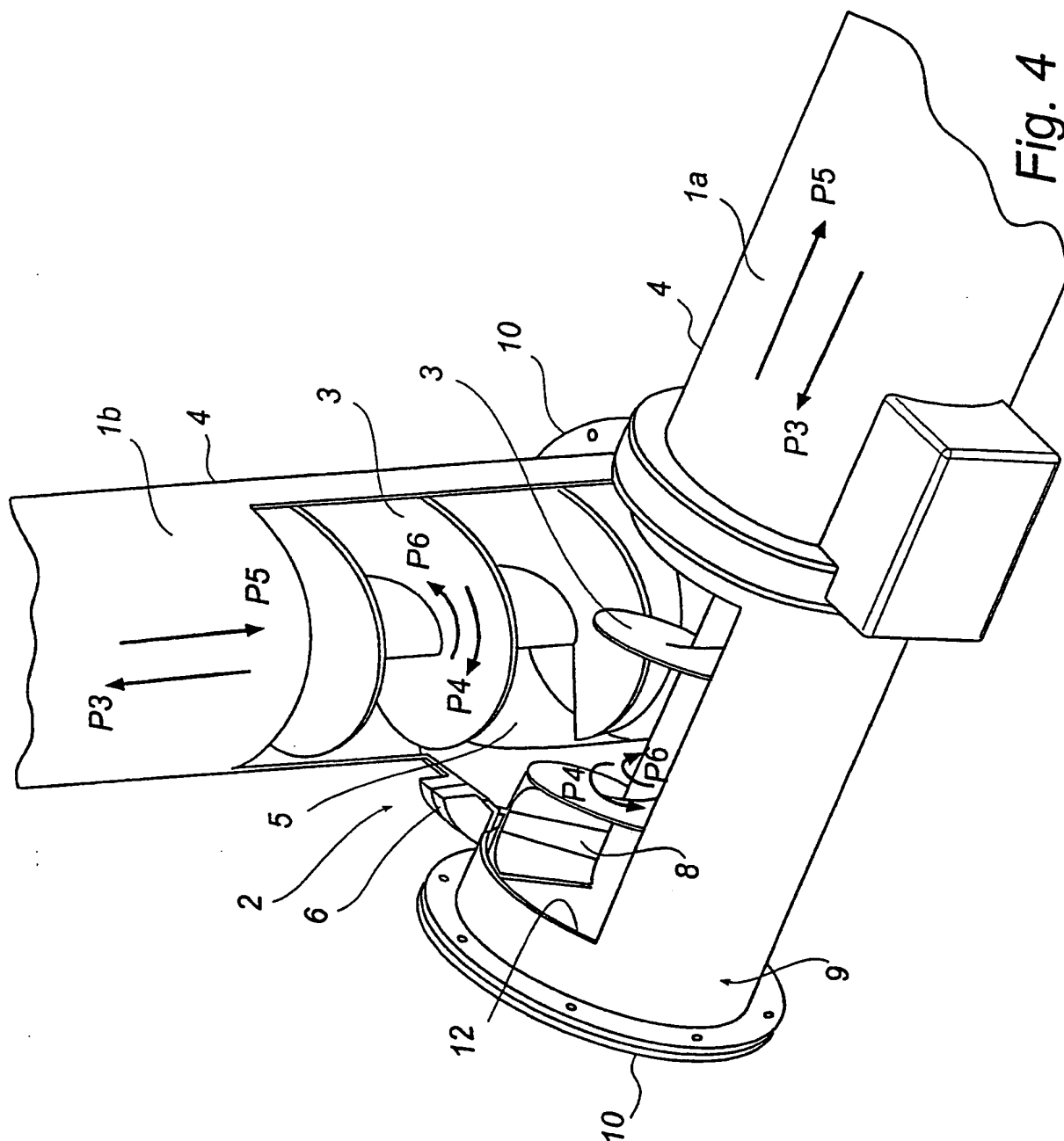
29. A plant as claimed in claim 28, wherein all conveyors (1a, 1b) included in the plant are of a screw conveyor type.

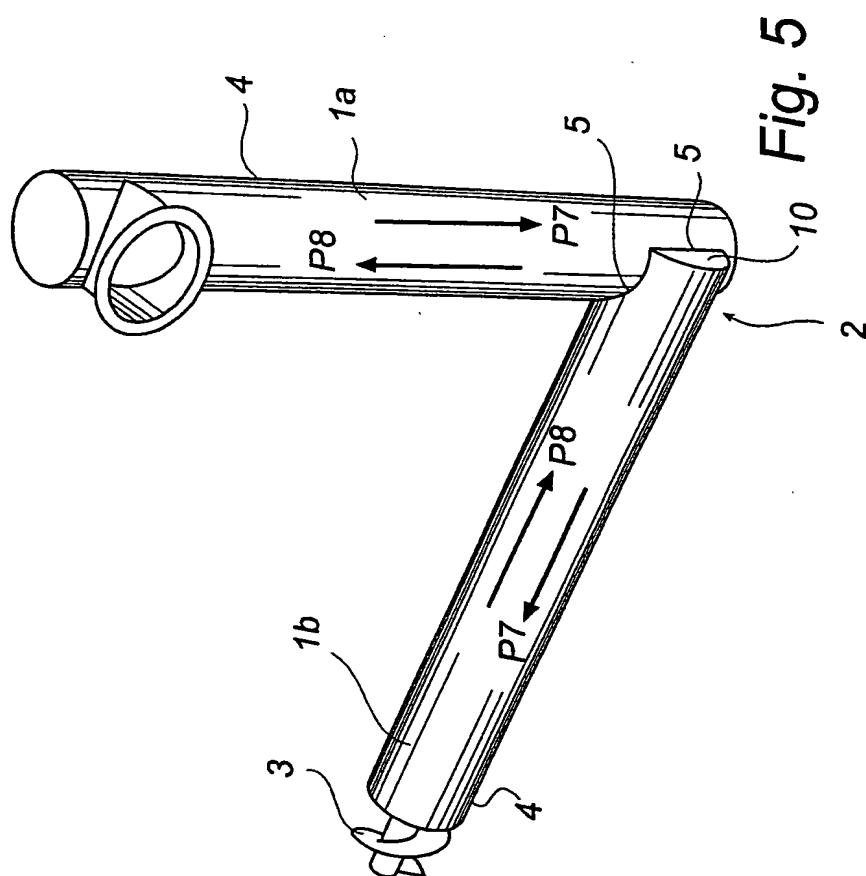


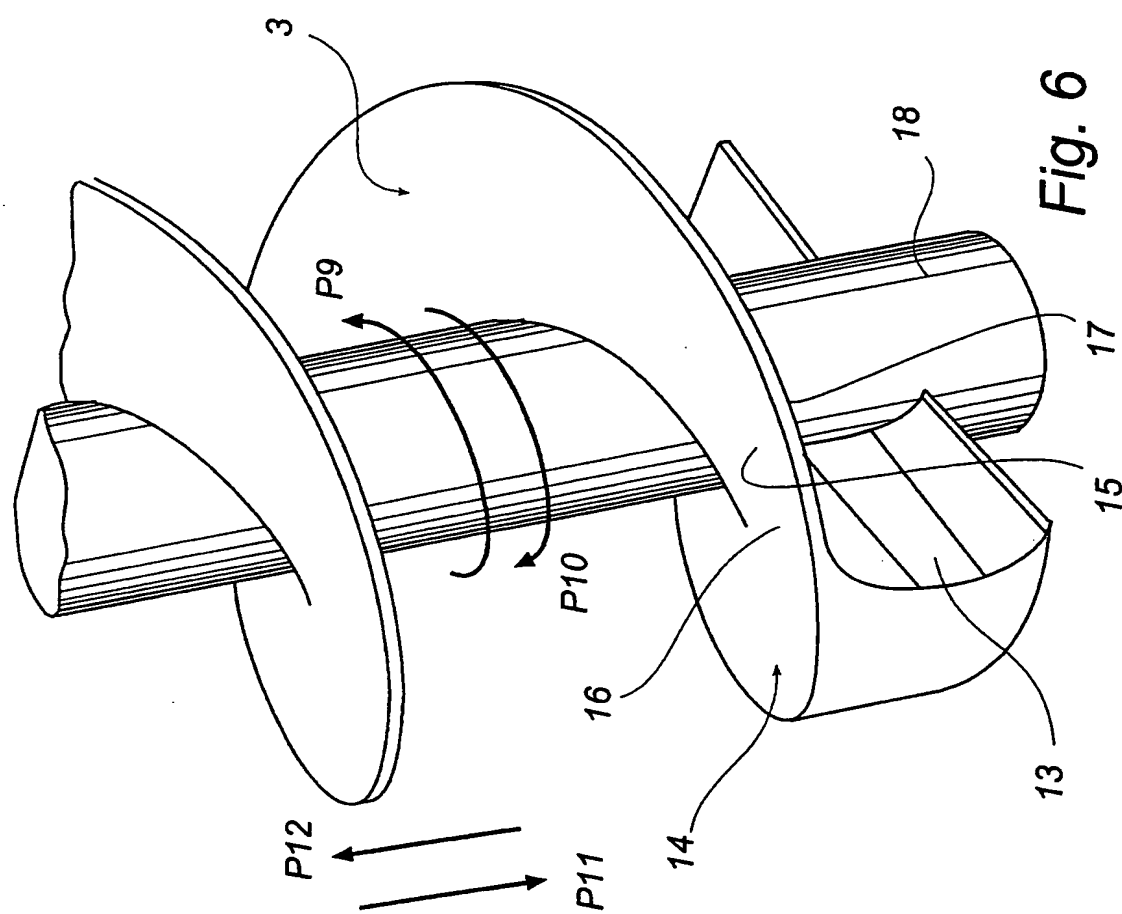


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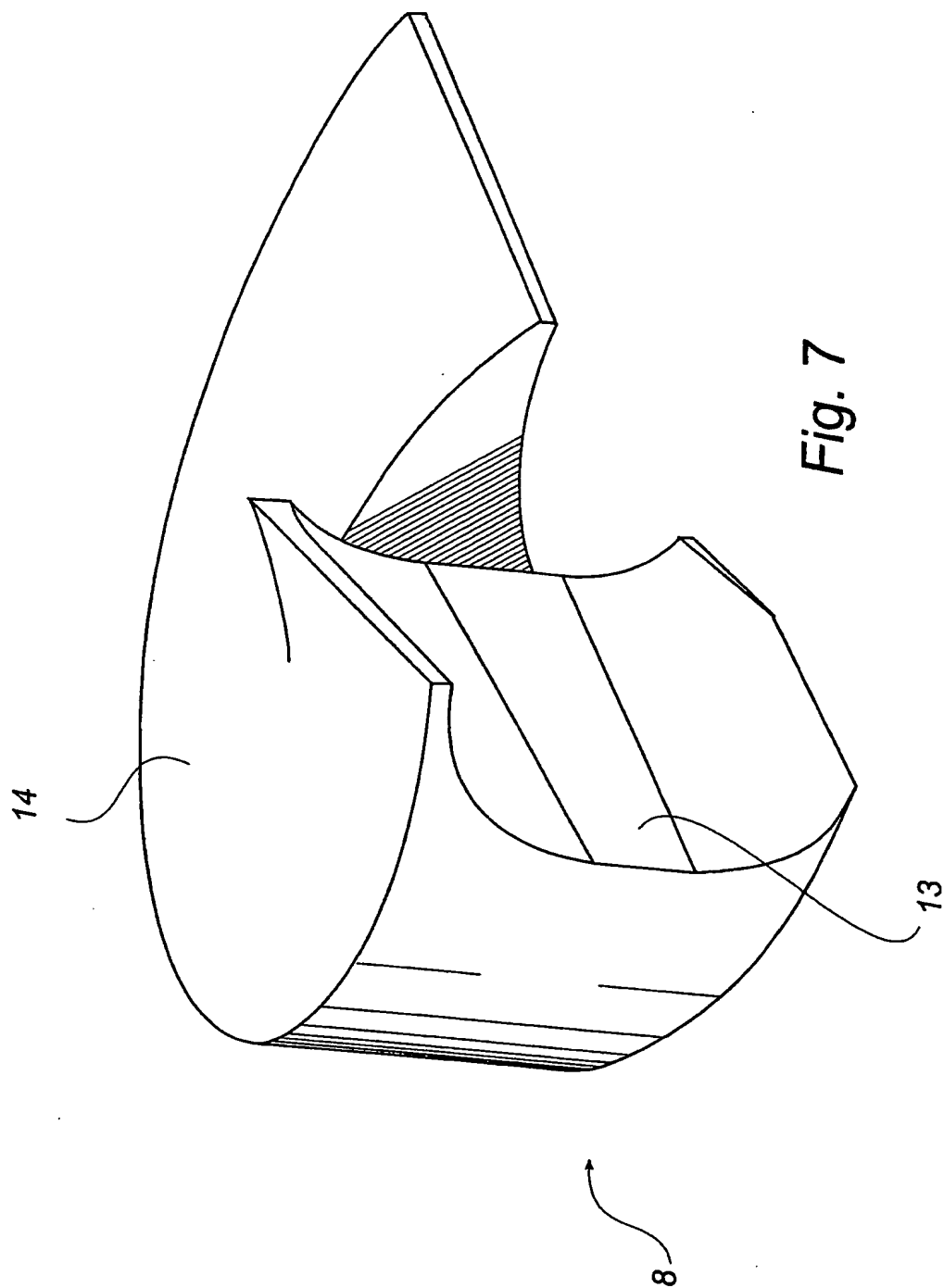








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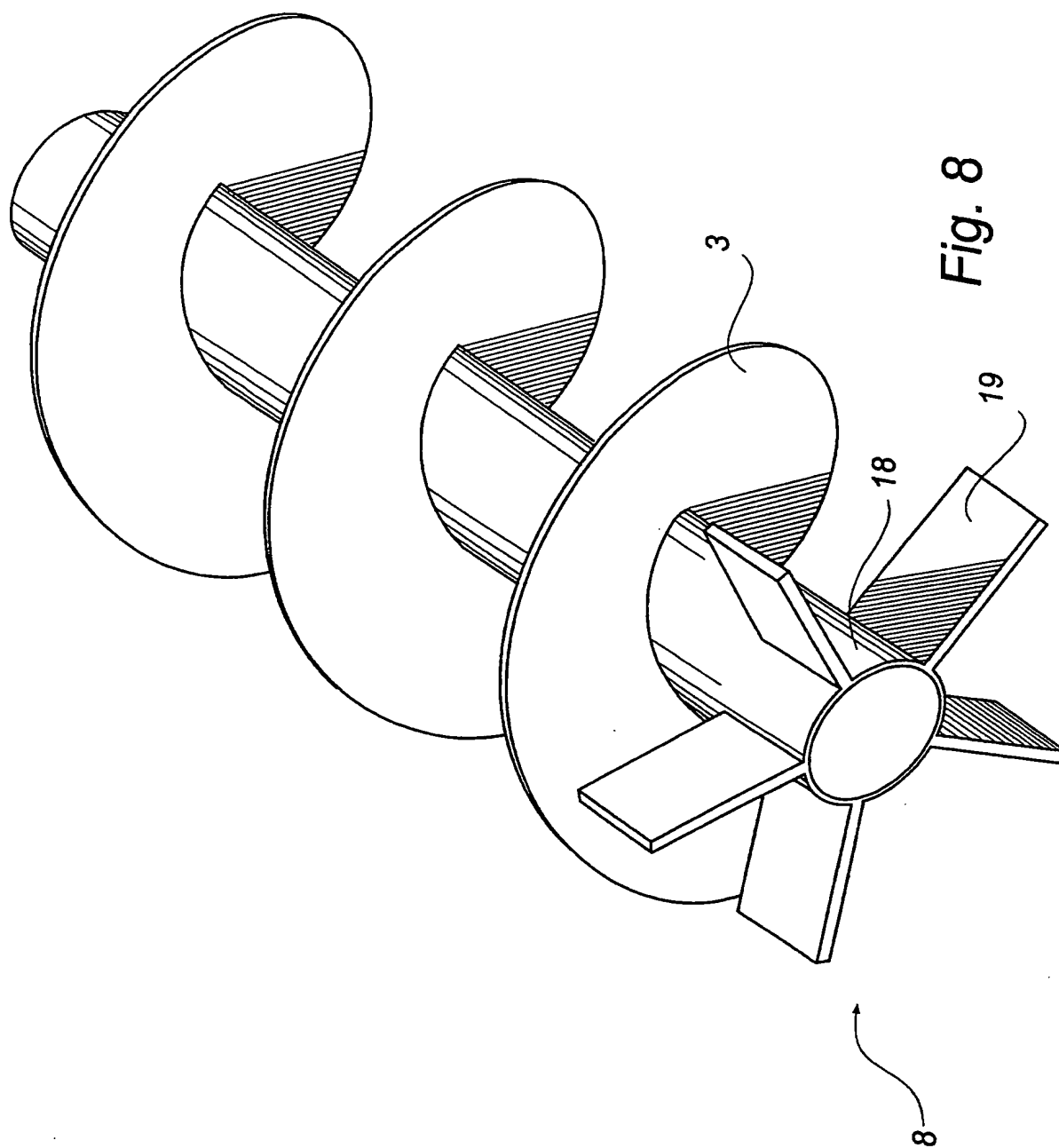


Fig. 8

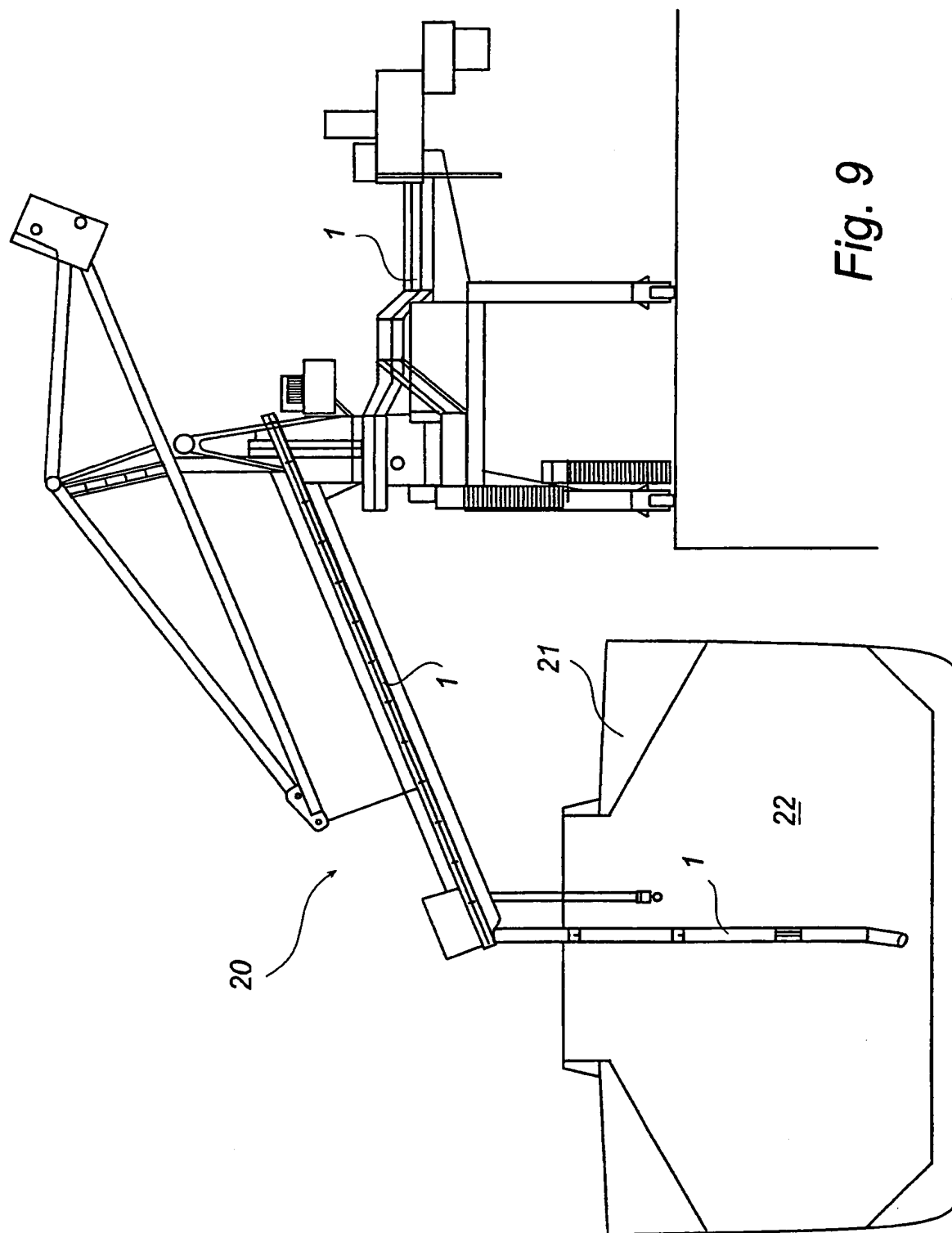


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01074

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65G 33/14, B65G 47/53, B65G 67/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0019166 A1 (GEBRÜDER BÜHLER AG), 26 November 1980 (26.11.80), figure 1, claims 1-3, 7,16 --	1,4,23
A	GB 1168055 A (PIETRO LAVERDA), 22 October 1969 (22.10.69), figure 2, claims 1-3 --	1-3,21-23
A	GB 1349581 A (HEADLEY JIM HODGE), 3 April 1974 (03.04.74), figure 1, claim 1 --	1-3,23,28-29
A	WO 8909739 A1 (CONSILIUM-NORDSTRÖM AB), 19 October 1989 (19.10.89), figure 1, claims 1-4 -- -----	1-3,28-29

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

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Name and mailing address of the ISA
Swedish Patent Office
Box 5055, S-102 42 STOCKHOLM
Facsimile No. +46 8 666 02 86

Authorized officer

Igor Gazdik/js
Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

28/06/00

International application No.

PCT/SE 00/01074

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